

On-surface azo-coupling reaction of p-aminophenol on Cu(110)

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One of the potential challenges in materials science is the synthesis of novel materials with new and desired properties. On-surface chemistry is a recent and promising field that provides the basic tools to manage this goal [1], and this approach allows the synthesis of new materials sometimes not accessible with conventional techniques [2].

In this work we have studied the thermally activated chemical reaction of p-aminophenol (p-AP) induced by the Cu(110) surface in UHV environment. A multi-technique study using STM/nc-AFM, LEED, XPS and NEXAFS, as well as DFT calculations was employed to unveil the structural and chemical characteristics of the process and its outcome. This work reveals that by simple thermal activation two p-AP molecules undergo an azo-coupling reaction to form 4,4'-azobis(phenol) (ABP). These molecules arrange in a flat geometry on the Cu surface forming highly organized molecular rows that are aligned out of the main crystallographic Cu(110) surface directions (Fig 1). XPS N1s spectra reveal an oxidation reaction from amine to imine while XPS O1s data suggests that oxygen atoms could be covalently bound to the substrate.

In summary, we have obtained a novel aromatic azo-compound by an on-surface thermally activated process, which evidences the enormous potential of this advanced strategy. The multi-technique study allows us to propose a model for this reaction.

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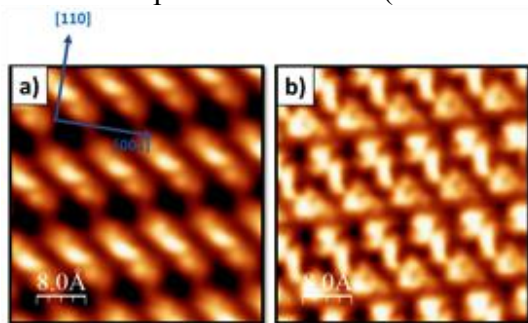


Fig. 1: Experimental high resolution images at constant height recorded at 4K with a CO functionalized tip. a) STM image (current). The blue arrows indicate the Cu(110) surface directions. b) AFM image (frequency shift).

References

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